new zealand wind energy association

www.windenergy.org.nz

The New Zealand Wind Farm Noise Standard

There are a number of New Zealand Standards that deal with the management of environmental noise. Some deal with sound in general (NZS 6801 and NZS 6802), while others deal with particular sources of sound, such as construction (NZS 6803), airports (NZS 6805), heliports (NZS 6807) and ports (NZS 6809).

NZS 6808 is the New Zealand Standard that recommends limits on noise from wind farms. The 2010 edition replaces the earlier edition published in 1998.

WHY IS A SPECIFIC STANDARD NEEDED FOR WIND FARM NOISE?

General acoustics standards such as NZS 6801 are designed for measurements in wind speeds below 5 metres per second (m/s), which is relatively calm. However, wind turbines operate in wind speeds typically from 4 m/s to 25 m/s and their sound levels vary with wind speed. High wind speed conditions also create increased environmental sound from vegetation and can affect the microphones used to measure the sound.

For these reasons, to accurately assess and measure sound from wind turbines a specific method is needed that enables sound to be measured and assessed in windy conditions. The Wind Farm Noise Standard provides this.

The 1998 version of the Wind Farm Noise Standard was written prior to significant wind farm development in New Zealand. The basic methodology of the 1998 Standard was robust, but experience and research in intervening years had highlighted the need for refinements and enhancements. The Energy Efficiency and Conservation Authority (EECA) and the New Zealand Wind Energy Association (NZWEA, the industry association representing companies involved in New Zealand's wind energy sector), co-funded Standards New Zealand to undertake an independent revision of the 1998 Standard to incorporate this research and experience.

WHAT DOES THE STANDARD DO?

NZS 6808:2010 provides suitable methods for the prediction, measurement and assessment of sound from wind farms that takes into account the factors that are specific to that sound. It also recommends limits on the level of sound that can be heard from locations near wind farms. It will be used by wind farm developers, acoustics specialists, councils and others involved in setting and monitoring wind farm noise limits in resource consent conditions.

The noise limits recommended in the Standard are intended to provide protection against sleep disturbance and maintain a reasonable amenity at locations surrounding a wind farm.

People living near a wind farm may still hear the wind farm at times, but if the limits recommended in the Standard are properly applied the level of sound will not be unreasonable or out of place with other sounds in the environment. This approach is consistent with how sound from other sources is managed, such as from ports and airports.

The original NZS 6808:1998 was used as the basis for conditions for all wind farms granted consent since its release. The new version is likely to be the basis for consent conditions for all newly consented wind farms in New Zealand. It has been specifically written with such application under the Resource Management Act (RMA) in mind.

The Standard includes model consent conditions designed to ensure correct implementation. These conditions will provide local councils with practical enforcement measures when included in a consent or designation.

WHAT LIMIT DOES THE NEW STANDARD RECOMMEND?

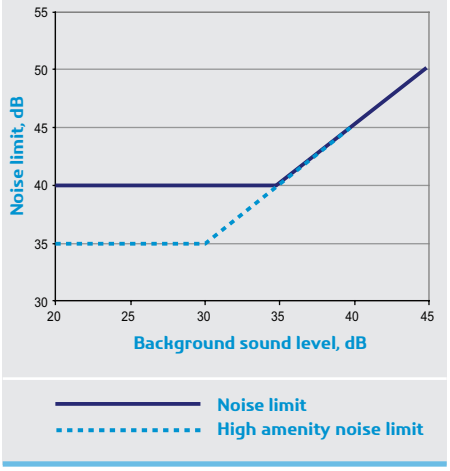
The 2010 version retains the recommended noise limits in the 1998 version, which is that the level of sound from a wind farm should not exceed the background sound level by more than 5 decibels (dB), or a level of 40 dB $L_{A90(10\ min)}$[1], whichever is the greater.

40 dB is typical of a quiet residential area with only light traffic and natural sounds such as the wind in the trees. In contrast, sound levels along-side an urban road would be around 60 to 70 dB during the day and about 50 to 60 dB at night.

There are some locations that are particularly quiet at times and so the recommended limit of 40 dB would be considered to be unreasonable.

In recognition of this the 2010 Standard introduces the provision for a lower, more stringent limit where a local authority has identified in its district plan the need to provide a higher degree of protection of acoustic amenity. The Standard recommends that when particular conditions are met, the sound from the wind farm during the evening and night time should not exceed the background sound level by more than 5 dB or a level of 35 dB $L_{A90(10\ min)}$, whichever is the greater.

Figure 1 – Relationship between background sound level and recommended noise limits



HOW ELSE DOES THE 2010 VERSION DIFFER FROM THE 1998 VERSION?

In addition to the provision for a lower, more stringent limit in special circumstances, a number of technical changes have been made and additional guidance added to the Standard that reflects the knowledge and experience gained from the use of the original edition of the Standard.

The measure of sound levels has changed from L95 to L90[2] to bring the Standard into line with the L90 descriptor used in other updated New Zealand Standards.

1. The A-frequency-weighted L90 centile level (expressed as $L_{A90(10\ min)}$) is the metric used in the Standard for wind farm sound. This metric avoids sound measurements being dominated by sound levels only present for a small part of the time and reduces contamination by the sound of wind on the microphone when levels are being measured.

2. Meaning the sound level equalled or exceeded for 90% of the time

The new Standard provides better protection for communities by explicitly addressing issues such as:

- cumulative effects from multiple wind farms or wind farms developed in stages
- forewarning prospective residents of an area already affected or permitted to be affected by wind farm sound (reverse sensitivity)
- specific audible characteristics (amplitude modulation).

The prediction and measurement methods have both been tightened up. The prediction method now requires more refined calculations, with consideration of a wider range of factors affecting sound propagation, including different frequency components. The measurement method is now more robust with numerous refinements, including wind speed reference at the turbine hub-height to avoid errors from wind shear estimation.

WHY DOES THE STANDARD RECOMMEND A LIMIT THAT IS RELATIVE TO THE BACKGROUND SOUND LEVEL?

Both the 1998 and new 2010 versions of the standard recommend a relative noise limit of the 'background sound level plus 5 dB', to provide a reasonable level of protection for noise sensitive activities while acknowledging the variable effects of wind on background sound levels.

In many instances when the wind is blowing the background sound may be over 40 dB. Restricting the operation of wind farms to 40 dB when the background sound is louder – and so likely to mask sound from a wind farm – provides no benefit to nearby residents and would prevent verification of the wind farm's sound level.

WOULDN'T IT BE SIMPLER JUST TO KEEP WIND TURBINES A MINIMUM PHYSICAL DISTANCE AWAY FROM HOMES?

A number of factors influence the level of wind farm sound heard at any given location, including:

- the shape of the land and its ground cover
- speed and direction of the wind
- ambient (or background) sound levels
- acoustic characteristics of the sound itself
- the number, size and type of turbines in the wind farm.

For this reason a set physical distance would not be sufficient to ensure residents were protected from unreasonable noise, unless that distance was made so large as to prevent reasonable wind farm development. The Standard provides a way of determining the actual noise effects of a wind farm that takes into account all of these factors, and so ensures that nearby residents are not exposed to unreasonable sound levels. This approach is consistent with the Resource Management Act.

WHO WAS INVOLVED IN THE DEVELOPMENT OF THE 2010 STANDARD?

The Standards New Zealand committee that developed the Standard included representatives of local authority and community interests, engineering and scientific experts in acoustics, practitioners in planning, resource management and environmental health and wind farm developers.

They were nominated by:

- Energy Efficiency and Conservation Authority
- Executive of Community Boards
- Local Government New Zealand
- Massey University
- Ministry for the Environment
- Ministry of Health
- New Zealand Acoustical Society
- New Zealand Institute of Environmental Health Inc.
- New Zealand Wind Energy Association
- Resource Management Law Association
- University of Auckland.

Each nominating organisation had one vote on the committee.

When preparing the revised Standard, the committee combined their extensive practical experience of wind farm sound with the reviewed literature. Where there was an area of debate, the committee turned back to the scientific evidence and analysed and tested that evidence to determine the appropriate resolution.

The committee began its work in July 2008 and produced a draft Standard for public comment in February 2009. The public comment period lasted two months. A total of over 600 comments were received from a wide range of submitters. Each comment was reviewed by the committee and, where appropriate, changes were made to the draft before the committee reached consensus on the final published version of the Standard.

This Standard represents the best efforts of the committee members to find a solution to all issues raised. The consensus view of the committee is that the Standard provides a reasonable way of protecting health and amenity of nearby noise sensitive locations, without unreasonably restricting the development of wind farms.

WHAT THOUGHT DID THE COMMITTEE GIVE TO THE ALLEGED HEALTH EFFECTS OF WIND TURBINES?

When drafting the Standard the committee considered a wide range of published material on the effects of wind farm noise on people's health, including the effects of low frequency sound. The committee determined that, based on available evidence at the time the Standard was drafted, the noise limits in the Standard provide protection against adverse health effects.

Recommendations in both the 1998 and new 2010 versions of NZS 6808 are based on the World Health Organisation's guideline noise limit of 30 dB L_{Aeq} inside bedrooms to prevent sleep disturbance. This equates to the noise limit in the Standard of 40 dB $L_{A90(10\,min)}$ outside, as sound attenuates – or become quieter – as it travels through walls and windows.

WILL THE STANDARD APPLY TO ALL SIZES OF WIND TURBINE?

The Standard generally applies to wind turbines with a swept rotor area greater than 200 m^2 (for example, individual blade lengths greater than approximately eight metres). Wind turbines with a smaller swept area are generally covered by the provisions of Standards relating to general environmental noise (NZS 6801 and NZS 6802), although they may require special measurement procedures to account for the effects of wind noise.

Local authorities may chose to apply the Standard, in whole or in part, to small wind turbines.

More Information

Find out more about wind energy and wind farms in New Zealand at www.windenergy.org.nz.

NZS 6808 can be purchased from www.standards.co.nz

NZ Wind Energy Association

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The New Zealand Wind Energy Association (NZWEA) is an industry association that works towards the development of wind as a reliable, sustainable, clean and commercially viable energy source. We aim to fairly represent wind energy to the public, government and the energy sector. Our members include 80 companies involved in New Zealand's wind energy sector, including electricity generators, wind farm developers, lines companies, turbine manufacturers, consulting firms, researchers and law firms.

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